SCHOOL ARCHITECTURE[1]

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The old ideas of school construction, with the poor ventilation, inadequately lighted rooms, and their many other inconveniences, are rapidly being discarded. In many of the new buildings scientific principles of modern school architecture are incorporated. Of recent years this development has extended to every part of the civilized world, not only in the vital points just referred to, but in all points of construction. We have but to glance over the prize essay of Dr. Alcott, written in 1831, to find that his ideal for a schoolroom was one lighted on opposite sides. George B. Emerson, in 1842, advised less than 118 cubic feet of air per pupil in schoolrooms. Burrowes published in 1855 a treatise in which the heating and ventilating of schools were gone into in great detail, and for a room to accommodate fifty pupils he allowed vent ducts only ten by eighteen inches.

These gentlemen were the authorities of their day, and their suggestions in the construction of school buildings were widely circulated and followed; but the revolution in all matters pertaining to school construction and administration has changed the requirements for the modern school. A great factor in the advance of school work is due to the public demand for better things. Our school commissioners require that buildings shall be planned on correct architectural and sanitary lines, and so long as this educational movement advances, we can expect still greater progress.

Our new buildings are being properly equipped, and are hygienically and architecturally in keeping with the advance in education; heating, ventilation, and sanitation have been reduced

[1] Paper read before the Department of Business Education at the National Educational Association meeting, Asbury Park, N. J., July, 1905.

to such an exact science that there can be no excuse for an inadequately ventilated, poorly heated, or unsanitary school building. The sanitary conditions of the schoolroom having such an influence for good or bad upon the health and morals of the children, and bearing such weight in the success of the teacher, it is to the interest of everybody to be satisfied only with the best that science can produce.

The details of the modern school plan should be as carefully considered as the details of a hospital. It is encouraging to note that the school boards of the present day make themselves familiar with what is best in school planning, the result being that each year we see buildings that are better planned, better constructed, and properly designed, at an initial cost not greatly in excess of that under the old requirements.

Certain countries, states, and cities are fortunate in possessing laws governing the planning and construction of their school buildings. To assure these laws being carried into effect, it is required that plans be submitted to competent heads of departments for approval before any contracts are entered into. These laws are doing much good toward the development of school architecture, and their influence extends far beyond their own jurisdiction, neighboring states and cities benefiting by their influence. For an example: An architect who has designed a building under the foregoing restrictions, or a superintendent who under them has planned its details, will, when called upon to assist in the erection of a new building, in communities not possessing such laws, naturally use his influence to secure the best.

The laws controlling school construction succeed in establishing good conditions for the safety and health of pupils and teachers. This includes the fire-proofing of stairs and other parts of the building; the placing, construction, and number of exits; fire towers and outside escapes; the square feet of floor area and cubic feet of space that shall be allotted to each occupant in schoolrooms; the minimum height of ceilings; the amount of outside glass area; the proper lighting of the schoolrooms; the swinging of doors; construction of ceilings; heating, ventilation, sanitation, and other points of equal importance.

The underlying principles of modern school architecture may be divided into several different heads, such as the orientation, planning, construction, designing, and equipment.

The building site must be well considered, especially in respect to proper sanitary surroundings. Every precaution should be taken to avoid the possibility of dampness. The future possibility of obstructing the sunlight and the hazard of having surrounding buildings in close proximity should not be overlooked. The best-arranged plan will be a failure if these questions are not properly considered and solved. If the conditions are such that surrounding buildings preclude the proper lighting of schoolrooms, then reflecting prisms may be used to advantage. I do not recommend them, however, except as temporary assistance for old buildings. In a new building, if such conditions exist, I would prefer to design the rooms narrower, and place in the rooms lighted from one side a smaller number of desks. This brings up the old question of the exact number of pupils that should be accommodated in the schoolrooms used for the graded pupils. The tendency is to make forty pupils the maximum for any one room, especially in primary grades, and there are many good arguments in its favor.

In arranging a plan much depends upon the size of the ground allotted to the building, the number of pupils to be accommodated and their grade. An elementary rule is to avoid light walls, and use light courts as sparingly as possible, and never where the sunlight cannot at some hour of the day find its way into each room. The successful plan is the simplest in its disposition of corridors and rooms. Where possible, the entrances for the boys and girls should be near the ground level, avoiding the long flights of outside steps.

Keep the basement well out of ground. This space, if properly lighted, is valuable for playrooms, manual-training and other like rooms; which space is lost for successful use unless this condition is complied with. When the building is two stories in height, a high basement can be made to add materially to its dignity and architectural appearance. Ground-floor entrances should open into a commodious rotunda, and the rotunda should

communicate with the principal rooms on this floor, including locker-rooms, toilet-rooms (if placed in the building), and also the stairs leading to the floors above. In addition to these ground-floor entrances, one or more entrances should be provided from grade direct to the first floor. All stairways should be so planned that the bottom flights end in close proximity to the outside entrances. They should be of ample width, easy of ascent, with intermediate landings wide enough to avoid jamming or crowding; they should be fire-proof, and always well lighted.

Corridors must be generous in width, bright, and with as few turns or breaks in the walls as possible. Hat- and coat-rooms for the lower grades are properly placed when adjoining to and communicating with the schoolroom; but for the higher grades it is frequently more convenient to centralize them. Cloak-rooms must be ventilated and receive direct light. Their surrounding walls should extend to the ceiling, and the rooms provided with a separate compartment for each pupil.

A schoolroom having its length a little less than one and one-half times its width is well proportioned and admits of a good arrangement of desks on the long axis. Thirty-two feet in length allows eight desks to a row and ample space for the teacher, who can, without effort, speak to a pupil at this distance. Twenty-three feet is a satisfactory width, which allows of five rows of seats and generous aisles. A room twenty-three feet by thirty-two feet approximates eighteen square feet of floor area to each of the forty pupils, and with a story height of twelve feet gives 200 cubic feet of air space for each pupil.

The English, French, and Dutch school laws, published for the guidance of architects in planning school buildings call for a smaller width of room, some fixing the height equal to two-thirds of its width plus the thickness of the walls in which the windows are placed. To obtain the best of results, the schoolroom should be thirteen feet in height. Some advocate a greater height, but I believe it inadvisable, as it unnecessarily adds to the expense of construction and increases the distance in traveling from floor to floor.

Seldom does it happen that too much light is secured. The

greatest amount should unquestionably come from the left of the pupil. In corner rooms, where it is desirable to place windows at the rear, they should be placed near the angle, in order that teachers will face wall surfaces as much as possible. The upper portions of windows furnish the most desirable light; therefore the windows should extend close to the ceiling. The glass surface should not be less than one-fifth of the floor area. The inside vertical jambs should be flared, and the windows should be spaced in the walls at regular intervals. Transoms and circular head windows are to be avoided, as they obstruct the light. A few wide windows are preferable to a number of smaller ones. Wood wainscoting should be eliminated from the schoolroom. By keeping the window-sills, chalk-tray, and chair-rail at the same height, together with the picture-mold, a division of the walls is secured that is both effective and economical. A large unobstructed area of slate blackboard is essential to the schoolroom. The space immediately back of the teacher's desk is especially valuable for this purpose, and should be kept free from obstruction.

Double sash and weather stripping are to be recommended in cold climates; while they add somewhat to the initial cost of construction, they save in fuel and add to the comfort of those occupying the room.

No schoolroom is complete without a teacher's book-closet, provided with shelves and hooks. Every school building should be planned for a teacher's room, properly equipped, where in cases of emergency it can be used as a temporary hospital.

The plumbing should have the most careful consideration, as the health of the children may be affected if this work is not properly installed. Tests of the plumbing should be made at stated intervals. The sanitaries, if placed in the building, should be automatic in their flushing, and ventilated independently of other parts of the building.

Pupils in class- and study-rooms should be supplied with not less than thirty cubic feet of fresh air per minute, and an equal amount of vitiated air should be exhausted to the atmosphere at a point most extreme from where the fresh air is taken into the

building. To do this successfully, and at the same time obtain properly warmed air, a mechanical system of indirect heating and ventilation must be installed in buildings containing more than four classrooms with both supply and exhaust fans, and where steam is used for the motive power the exhaust can be utilized as supplementary heat to temper the air before passing over the heating surface. Where furnaces are used to warm the fresh air, the exhaust from the motive power can be used to advantage by direct radiation, to heat the rooms used for administration work which allows of their comfortable use without starting the fans. In designing the heating and ventilating apparatus economical results can be secured by revolving the air in the building until occupied, and also by controlling the tempered and warm air delivered to the rooms.

In buildings devoted, wholly or in part, to the higher branches of education, the plan naturally becomes more complex, but the general principles of school-planning remain the same. Such buildings are larger and more pretentious, the details of which should have the most careful thought and study. It is necessary to plan for the assembling of all pupils at certain intervals, to provide for the diversified class work, together with accommodations for the society and athletic work, all of which are important. It is in this class of building that you will frequently find accommodated the administrative branch of the schools, rooms for the board of education, the secretary, and the superintendent. This department should be of easy access to the public, and provided with toilets, fire-proof vaults, and rooms for the unpacking, sorting, marking, and storage of supplies. The assembly-room, owing to its large floor area, naturally dominates the plan. This room should be placed on the first floor, where it is easy of access, and where any danger in dismissing large assemblages is reduced to the minimum. There is also the advantage of simplicity of construction and economy of space.

The plan of the assembly-room depends largely upon the purposes for which it is to be used. It can be of the amphitheater pattern with galleries, where commencement and institute meetings may be held; or it may be much simpler in form, when used

solely for the daily opening and closing exercises. By placing the scientific branches and other departments of special work on the top floor, the lower floors are left for a good arrangement of class-, study-, and recitation-rooms.

It may be of interest to describe here a high-school building, now under construction at Reading, Pa., in which the plan has been most carefully studied. It is one of a very large number of similar buildings that are now contemplated or under the course of construction.

The Reading building is to accommodate 800 boys, three stories and basement in height, thoroughly fire-proof. The auditorium is placed on the first floor with dividing partitions, giving a total seating capacity of 1,500. Two of these divisions may be used for large classrooms, and the two center divisions for lecture- and assembly-rooms. On the first floor are also provided rooms for the library, visitors, principal, and faculty; also class-rooms and cloak-rooms. The second floor is entirely devoted to class- and recitation-rooms, and the gallery of the assembly-room. The third floor is divided into laboratories with their class- and lecture-rooms, commercial, banking, and typewriting-rooms, and professor's private rooms, drawing- and modeling-rooms, and room for photography.

The basement accommodates, besides the rooms for manual training, lunch- and drill-rooms, and rooms for athletics, the necessary space for the heating and ventilating plant, consisting of a double-fan combination steam and warm air heating and ventilating apparatus, with a complete system for regulating the temperature in all parts of the building.

The construction throughout is the best. The exterior is of granite, brick, and terra-cotta. The interior is of iron and concrete construction, with metal and hollow tile partitions. The floors and walls of corridors, cloak-rooms, and toilets are of white tile. The stairs are built of iron and slate; soapstone is used for the finish of walls in classrooms, and the floors are of narrow maple boards. The little woodwork used is of quartered oak. Each corridor is equipped with sanitary drinking-fountains, fire lines, janitor's closets, and supply rooms.

The construction of the modern school building, where possible, should be fire-proof. Where sufficient funds are not available, every precaution should be taken to make the building slow-burning. This can be accomplished, to a large extent, by using metal lath in place of wood stripping and wood partitions, and supporting the ends of all beams on masonry walls. With this construction, together with the use of fire-proof stairs built between brick walls, the building is made safe, but the many annoyances due to the shrinking of wood would not be overcome, but can be greatly reduced by subjecting the building to a good trial of the heating plant for a few weeks before the building is plastered.

I have stated before that the school building should be as carefully planned as a hospital. It also should be as carefully constructed and finished; everything that is difficult to keep clean should be avoided. Finish the floors above the basement in schoolrooms with narrow hard lumber, and the walls with a smooth tinted surface. The walls of cloak-rooms, toilets, halls, and basement rooms should be wainscoted with enamel brick.

The finish building materials should be non-absorbent; and combustible materials should be used only where absolutely necessary. Avoid as much as possible all unnecessary projections which catch the dust.

As to the exterior, it should be simple and refined in design, materials only being used that are substantial and lasting, and each building should have that dignity and beauty obtained by simple and straightforward means, without sacrificing economy or the requirements of utility. The beauty of the building should reside in its proportions, and in the lines and grouping of the doors and windows, without superfluous ornamentation.

It is not necessary or desirable to go into an elaborate expenditure of money in the construction or equipment of school buildings. They should be built well and equipped substantially. The desire to surround the children with the beautiful during their receptive age can be materially assisted by supplying each building with a well-selected collection of beautiful pictures and casts.

In closing, I will make a plea for the enactment of more

BLUE PRINTS MADE BY THE CHILDREN ON PAPER WHICH THEY HAD COATED

effective legislation pertaining to the erecting of our school buildings, and in this legislation I would suggest that a fire limit of forty feet or over, including streets and alleys, be left between the building and the adjoining properties. Such a law would not only protect the building from outside fire, but would always assure the proper lighting and air space, and would be the means of adding to the architectural effectiveness of the structure.